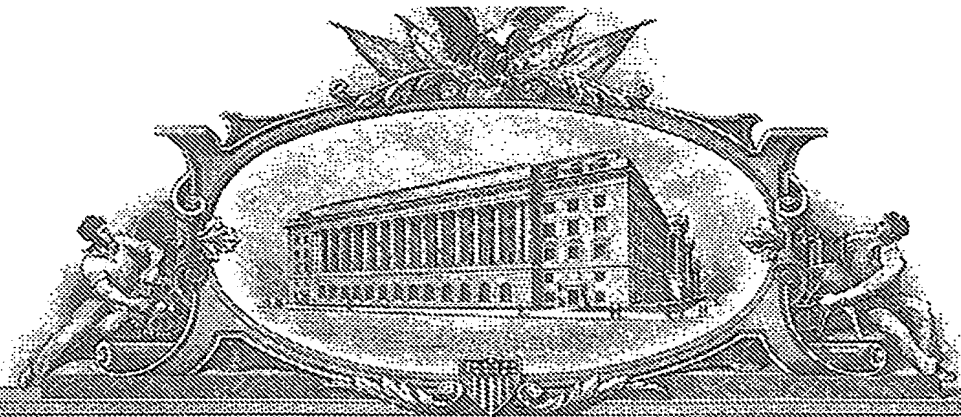


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PROVISIONAL APPLICATION COVER SHEET

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DOCKET NO.: 8822-88PX(189212)			Type a plus sign (+) inside this box →		+
INVENTOR(S)/APPLICANT(S)					
LAST NAME	FIRST NAME	INITIAL	RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY)		
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TITLE OF THE INVENTION (maximum 280 characters)					
PAINTBALL, PAINTBALL CORE, AND METHOD OF MAKING					
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STATE	PA	ZIP	19103	COUNTRY	US
ENCLOSED APPLICATION PARTS (check all that apply)					
<input checked="" type="checkbox"/> Specification	Number of pages: 9		<input checked="" type="checkbox"/> Small Entity Status Is Claimed		
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<input type="checkbox"/> The Director is hereby authorized to charge filing fees to Deposit Account No. 500573.			<input checked="" type="checkbox"/> \$ 80.00 (small entity)		
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

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Respectfully submitted, 

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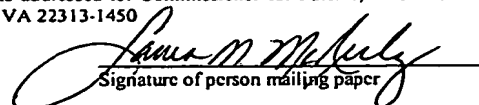
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PAINTBALL, PAINTBALL CORE, AND METHOD OF MAKING

BACKGROUND

In recent years, the popularity of the combat game known as "Paintball" has increased dramatically. In one form of this game, players on two teams are each supplied with a paintball marker and a number of paintballs, that is, rounds of ammunition. The paintballs comprise a spherical gelatin or similar shell filled with a non-toxic, water-soluble, biodegradable paint ("paintball marking paint"). Paintball markers fire these paintballs using compressed gas (e.g. CO₂, N₂, etc.) as a propellant. When a player is hit with a paintball, the ball ruptures, "painting" the target providing dramatic evidence of the hit, without injuring the player. Paintball games are organized on levels from local competition to international matches, and paintball outings are often set up between competing teams used for executive training and relaxation, or for military training maneuvers and the like.

Soft and hard capsules or casings have been employed in the sports and leisure fields to contain paintball marking paint formulations within capsules adapted to rupture upon impact with an intended target. Generally, such paintballs have the physical properties in which the casing is hard and impact resistant enough to survive high velocity projectile forces, while at the same time adapted to rupture and release the dye composition upon high velocity contact with

the target surface. Paintball is now a recognized and popular sporting activity, played by thousands of men and women throughout this country, as well as thirty other countries worldwide.

Currently available paintballs formed from gelatin or starch shells and filled with marking paintball marking paint suffer various deficiencies, both in manufacture, and in use. These types of paintballs are expensive to manufacture.

There exists a need in the field of paintball, for improved technology relating to paintball ammunition. In particular, there is a need to improve the attributes of paintballs, by provided a paintball that is efficient to manufacture, low cost, and safe to the environment.

DESCRIPTION OF THE INVENTION

The present invention is directed to both a paintball core, and a paintball having the core of the present invention. A paintball core according to the present invention comprises a core of a fibrous and/or porous material, such material capable of absorbing paintball marking paint ("paintball marking paint"). The paintball core of the present invention is then coated or sealed with an outer shell to form a paintball of the present invention.

The paintball formed according to the present invention has the following properties:

The core formed from a fibrous and/or porous, non-toxic, is capable of absorbing a quantity of paintball marker paint.

The core is stable, and will retain the paintball paint for a reasonable period of time before the paintball is used.

The outer shell is capable of protecting the core until the paintball is fired and impacts a target.

The outer shell is resistant to rupturing prior to being fired from a paintball marker, and impacting a target.

The core is essentially a combination of materials, such as rice straw as the fibrous or absorbent material, and paintball marking paint as the marking material. Other materials, such as binders, surfactants, or desiccants, may be incorporated into the core to achieve the desired properties.

Rice straw is produced throughout the world as a byproduct of rice cultivation. Rice straw is a fibrous composition, capable of absorbing liquid such as paintball marking paint. The porosity of rice straw may be controlled by grinding and drying. Is it possible to produce a paintball core formed from rice straw, where the void fraction is up to 80% of the volume of the paintball core. Rice straw is resistant to bacterial decomposition and therefore suitable to serve as a the core of a paintball, which will be stored and may not be used immediately.

Various agricultural byproducts may be used as an alternative to rice straw. For example, cellulosic materials, including but not limited to straws, grasses, palm waste, wheat straw, plant waste or paper mill waste, may be used to form the paintball core of the present invention. Those of ordinary skill in the art will understand that agricultural waste can also be termed biomass. Other materials, such as corn stover, kenaf, industrial hemp, sisal, rye grass straw, wheat straw, bagasse, hesperaloe, flax straw and combinations thereof, may also be used.

In addition, other cellulosic fibers may be used to form the paintball core of the present invention, including non-woody fibers liberated from sugar cane, bagasse, sabai grass, rice straw,

banana leaves, paper mulberry (i.e, bast fiber), abaca leaves, pineapple leaves, esparto grass leaves, and fibers from the genus *Hesperaloe* in the family *Agavaceae*. Also, recycled fibers which may contain any of the above fibers sources in different percentages can be used in the present invention. Suitable fibers are disclosed in U.S. Pat. Nos. 5,320,710 and 3,620,911, each of which is incorporated herein by reference in its entirety. It is appreciated that the paintball core of the present invention may be formed from combinations of any of the materials disclosed above.

As used herein, the term "fibrous material" or "absorbent material" means any of the above-listed materials. Rice straw is used as the primary example.

In one embodiment, the core of the present invention is formed from materials that are capable of carbonizing. Those materials which carbonize and thicken when exposed to heat are preferred, as described in greater detail below.

A method of making a paintball will now be described. In one embodiment, the rice straw or other fibrous material is ground, and then compacted to form a paintball core. The fibrous material is formed into the acceptable shape and size of a paintball by molds, by the use of a press, or any other suitable means. For example, rice straw or an alternate fibrous material formed into a slurry may be injected into round molds, and dried, or heated, or both. Alternately, soft, moldable rice straw may be placed between molds forming two halves of a paintball, which are brought together, capturing the rice straw within the mold halves. Alternately, dried fibrous material may be compacted by use of presses and dies (molds) into the desired shape, density and size.

Once the fibrous material is formed into an acceptable shape, density and size, paintball marking paint is introduced. Paintball marking paint may be incorporated into the fibrous material by wicking, or by dipping. Other methods of incorporating paintball marker paint into the fibrous material may be used, such as spraying or using a bath of paintball marker paint. Furthermore, the paint may be added to the core by injecting the paint into the mold after the core is formed.

To form a paintball, the core comprising fibrous material, paintball marking paint, and any other materials, is then treated with an outer shell as a sealant. Gelatin compositions, starch compositions, or plastic compositions may be used in forming the outer shell. The outer shell may also be formed from albumin, or a mixture of albumin and other suitable materials.

Several properties of the paintball core of the present invention can be controlled and manipulated in order to alter the characteristics, makeup and performance of a paintball formed utilizing the core of the present invention. For example, the degree the core is compacted during formation can be controlled in order to alter the density of the core. (The denser the core is the less the paint will permeate through the core.) The viscosity of the paintball paint can also be controlled in order to alter the weight of the paintball and the amount of paint "splatter" when a player is struck with the paintball. The amount the fibrous material and paintball marking paint are dried may be controlled. The granular size of the fibrous material, such as rice straw, can be controlled to alter the absorption properties, and therefore the final weight of the paintball formed with the core of the present invention.

Because of the various properties that can be easily and efficiently controlled when making a paintball core of the present invention, it is appreciated that a paintball formed

according to the present invention can be of any size and weight required by a paintball marker or a paintball sport player.

MOLD STAMPING

In one embodiment of the invention, the paintball core is made by taking fibrous material, such as rice straw, which is ground into a powder. Paintball paint is added to the powder until a slurry is formed. Binders such as cellulose, gelatin or plasticizers may be added to this mixture, to increase the viscosity of the slurry.

Molds are provided, each having a cavity that has a contour defining half the final core shape. In the case of a spherical paintball, each mold half defines half of a sphere. However, it should be readily apparent that the each mold can have more or less than a half of the shape (so long as the combination of mold portions substantially forms the core. Also it should be readily apparent that the core (and resulting paintball) need not be spherical in shape.

The molds are brought together, capturing a quantity of slurry within the sphere to form a paintball core.

The molds are then heated, or heat may be applied by the molds, to cure and harden the slurry to a desired firmness. The application of high temperature to the outside of the paintball core may be used, in order to sear the outermost layer, making the outermost layer of the core crisp and brittle.

As described above, in one preferred embodiment, the core is formed from rice straw. Binders may also be used to form a slurry, as discussed above. The core is stamp molded into

the shape of a paintball, as described. The fibrous material is then dipped into vats of paintball paint, or paintball paint is drawn into the fibrous material by wicking.

In one embodiment, where high temperature is applied for a short period of time, the inner portion of the core may remain moist, and the inner portion of the core will remain soggy.

In another embodiment of the present invention, the entire core is heated until the core is essentially dry, thus forming a compacted powdery or chalky core. This powdery or chalky core may also be heat treated so that the outermost layer is crisp and brittle.

A protective sealant may be applied to the paintball core, forming the outer shell, and finishing the paintball. The protective sealant may be applied by any acceptable method, including, but not limited to spraying, vat immersion, etc.

CAVITY MOLDING

In another embodiment of the present invention, the paintball core is formed by progressive cavity molds. A slurry formed from rice straw, for example, and paintball paint, is formed into a spherical mass. The slurry is formed, as described above, comprising rice straw and paintball paint. Binders may be added as well.

The spherical mass is heated and dried until a firm core is formed. The firm core is then moved to hot rollers. The core is turned on the hot rollers for a selected time at a selected temperature, until the outer portion of the core is carbonized. Essentially, the outer portion of the core will bake and char while turned on the hot rollers. The longer the core is turned on the rollers, the thicker the shell. As such, the core is turned on the hot rollers until a desired outer core or shell thickness is achieved.

The core is then coated, as described above, with a sealant.

ALTERNATE USES

It is contemplated that applications for the present invention may reside outside the field of paintball. For example, rice straw may be mixed with other materials, formed into a slurry, and dried. The dried powder may be used as a delivery vehicle. For example, rice straw may be mixed with a marking paint of some type, and also with, for example, oleoresin capsicum. Thus, a delivery system is formed that also incorporated a marking system.

One of the benefits that can be provided by the present invention is dimensional Stability. Using the present invention, the new paintball or projectile can be made to hold its dimensions more closely than existing paintballs because it is shaped by the filler not the shell. An existing paintball is a "balloon" filled with liquid. It therefore takes the shape of the container it is in. This means that during shipment and storage an existing ball can and will change shape. The change in dimension will adversely effect loading and flight of the ball. A paintball made according to the present invention has a solid matrix that will not deform under transport and storage. This solid shape is produced during manufacturing and can be formed in a consistent way with existing machinery.

Another benefit of the present invention is the ability to control fiber length and ball shape. During manufacture, fibrous materials can be added to the mixture of solids. By changing the type, length, thickness, weave and/or amount of these fibers the strength of the ball can be controlled. For example, paintballs that are used by police can be made tougher so they can penetrate barriers and foliage before breaking. The shape of the projectile can also be controlled using this technology. For example, the paintball can be formed with a tubular

pointed shape for directional and aerodynamic stability. These types of projectiles are designed to provide accurate and long distance shooting.

It is understood that the present invention is not limited to the particular embodiments shown and described herein, but that various changes and modifications may be made without departing from the scope and spirit of the invention.

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